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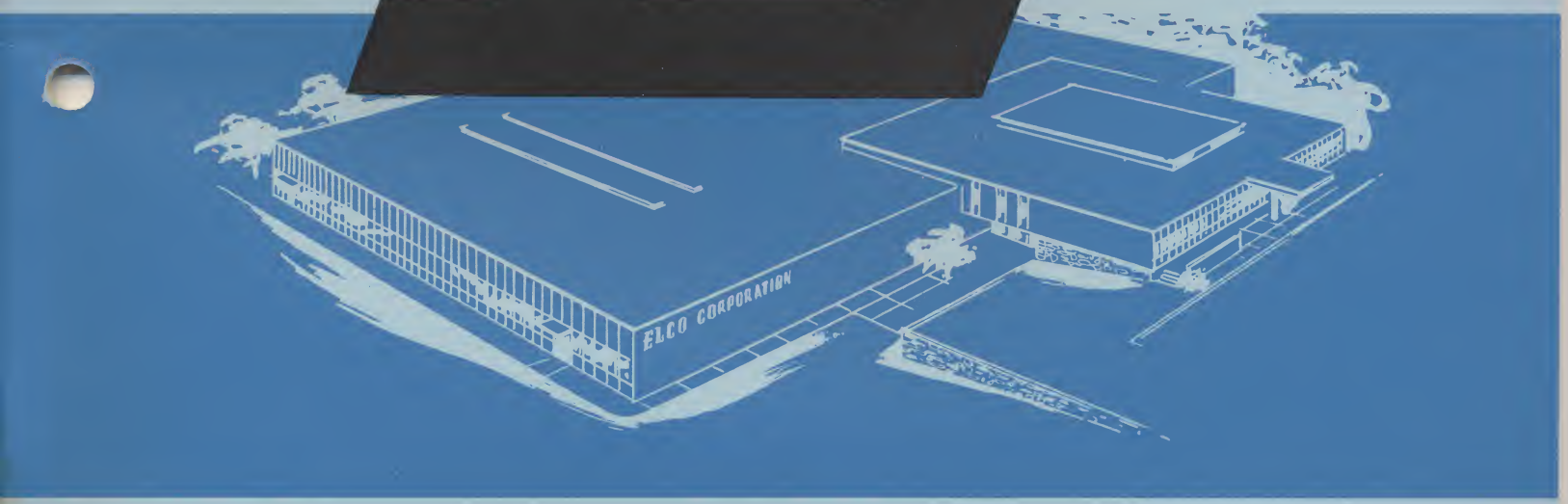

ELCO VARICON* Series 8200 Microminiature Connectors — Design, Function, Application

ELCO Corporation, Willow Grove, Pa. 19090

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ELCO VARICON* Series 8200 Microminiature Connectors — Design, Function, Application

This Bulletin describes various ELCO VARICON* Connectors, notably Series 8200, 8128, 8129 and 8208, and their application to miniaturized electronic equipment. These items have found wide acceptance throughout the industry; and other items are being developed continually. We invite your inquiries.

Compiled and Released by

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I. INTRODUCTION

A new line of microminiature ELCO VARICON* contacts has been engineered. This is the 8200 "family," by which a variety of applications has been accomplished based on the ELCO VARICON* contact principle. This easily permits design variations to meet countless specifications.

It is also important to note at the very start, that the ELCO 8200 "family" eliminates three frequent disadvantages of similar microminiaturized equipment.

First, when equipment is miniaturized, the price often increases. This is not true in the case of our new 8200 "family" because less material and less plating are required, whereas the production speed required to manufacture remains as constant as with our many standard series. Hence, our price also remains constant, or decreases slightly.

Second, when equipment is miniaturized, the tolerances required to produce the item become closer. This also is not true of the ELCO 8200 "family," since the contact area determining the performance is produced in our standard manner.

Third, when equipment is miniaturized, the performance and reliability frequently are adversely affected. Again, this is not the case with the 8200 "family" because it offers the same fork-like design and all other advantageous characteristics of the standard ELCO VARICON* contact.

GENERAL DESCRIPTION

The value of any connector is determined by the performance of its contact "nose." The dimensions of the Series 8200 "nose" are shown in Figure A.

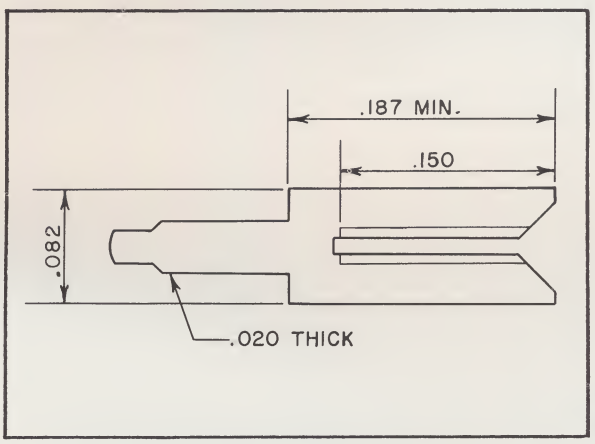

Figure A
(Enlarged to show details)

Material .020″ thick is the same Grade "A" phosphor bronze as in any standard ELCO VARICON* contact. The contact mating area is approximately 30% less than in the standard ELCO VARICON* contact; that is 4 times .008″ by .150″ (4 times the beveled coined areas). Therefore, the contact resistance for nickel-gold flash plated contacts is unchanged at .0035 ohm maximum. The current-carrying capacity range is 3 to 7 amperes, depending upon the density of mounting the contacts, as well as the termination configuration employed. Each prong of the "nose" can deflect about .007″ before taking a set. This is just .002″ less than in any standard ELCO VARICON* contact. The common relief hole at the bottom of the coined contact area has been omitted because the contact width of .082″ eliminates the necessity for the additional hole.

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Series 8200 "family" contacts are basically designed for packaging at .100″ square grid pattern. However, contact densities of .075″ and .050″ are possible as described in the following pages.

The smaller design configurations make it advisable to select slightly lower withdrawal values of 6 oz. average, with the same 2 to 16 oz. overall limits covering the entire range of various platings. The contact pressure at the four coined contact areas is of the same magnitude as standard ELCO VARICON* contacts, resulting in the same excellent performance characteristics. Standard ELCO VARICON* contacts and those of the Series 8200 "family" are inspected with identical gages, under identical conditions, thereby guaranteeing identical performance. Any Series 8200 contact can be mated with any standard ELCO VARICON* contact (if so required) and will perform in a like manner as any other ELCO VARICON* contact combination.

Presently, a variety of Series 8200 contacts has been manufactured with hard tooling, and additional contacts are available with economy tooling. A survey of the existing contacts is given on later pages of this report. Contact configurations in addition to those shown are being continually added.

Major basic applications of Series 8200 contacts in miniaturized equipment are delineated in the text, drawings and photographs which follow.

2. CONTACTS MOUNTED DIRECTLY TO LAMINATES

Several variations of card-to-card connectors are possible by using ELCO MICROCON* contacts. These contacts can be assembled to laminates of all kinds. They can be secured therein by staking, interference fit and/or soldering. Laminates without circuitry, as well as single-sided, double-sided or multi-layer circuit cards of any common thickness can be used. Contacts can be supplied loose or on plastic strips in a variety of predetermined spacing, patterns and numbers. Staking tools and support fixtures can be furnished on request.

a. Card-to-Card Perpendicular Connectors Series 5204

In the ELCO Series 5204 connector, module cards mate with base cards at 90°. Illustrated in Figure 1 is a small double sided module card with contacts assembled to the edge. The contacts are spaced on a .100″ grid at pre-selected patterns. Contacts can be assembled to one or both sides of the module card.

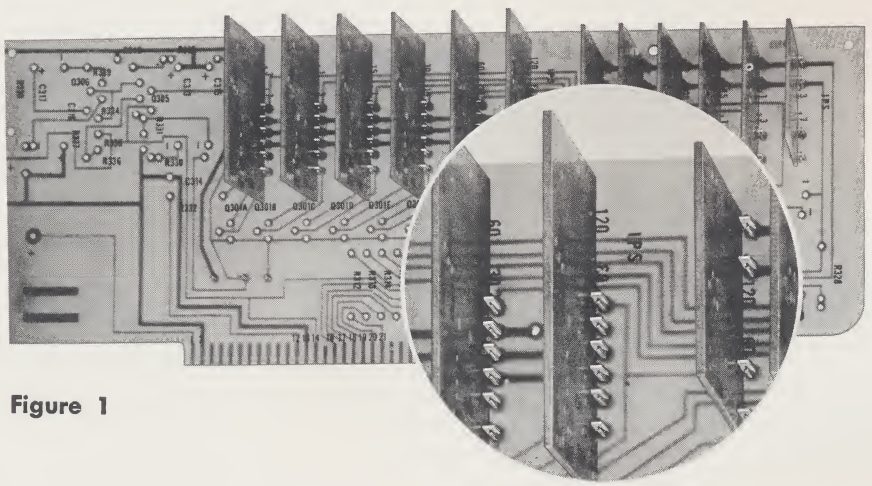

Figure 1

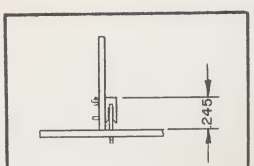

Figure 1a

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Figure 2 illustrates another variation of Series 5204 connector. It shows a large size multi-layer printed circuit type base card to which two larger groups of stand-off contacts are secured by staking and soldering.

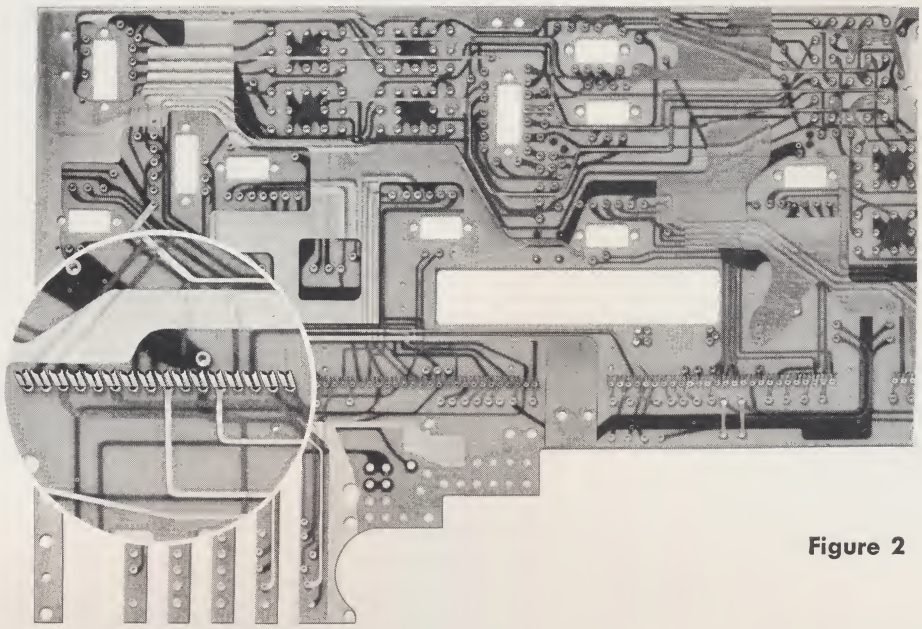

Figure 2

The closest spacing is .100″ between contacts and .181″ between 1/32″ thick cards, or .212″ for 1/16″ thick card. This is illustrated in Figure 3. Spacing of .150″ and .181″ respectively can be obtained by offsetting module cards .050″ from each other as shown in Figure 4.

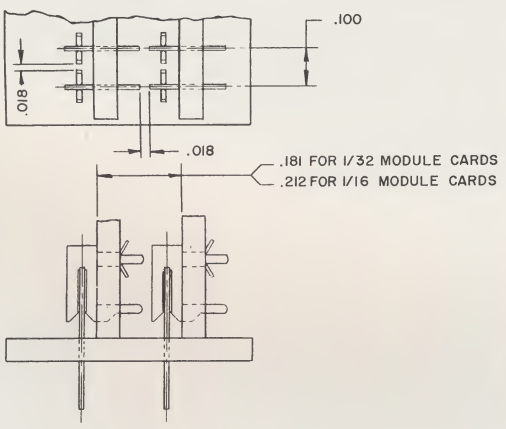

Figure 3

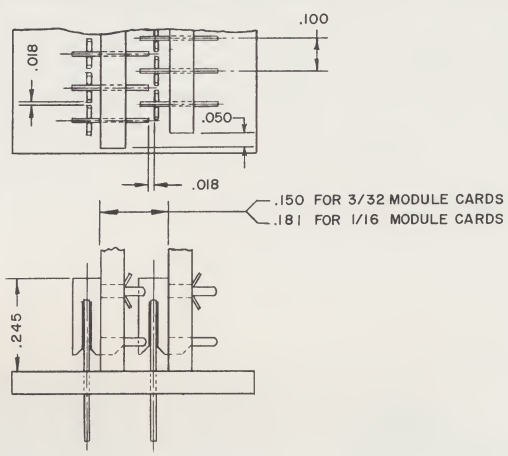

Figure 4

If base card contacts are "in-line" on .100″ centers, then air gap between exceeds 1/64″. Break-down voltage between contacts exceeds 1000 volts RMS, and is more than adequate for these applications. A maximum of 120 contacts per strip can be supplied. See Figures 5 and 6. Other spacings can be supplied on request.

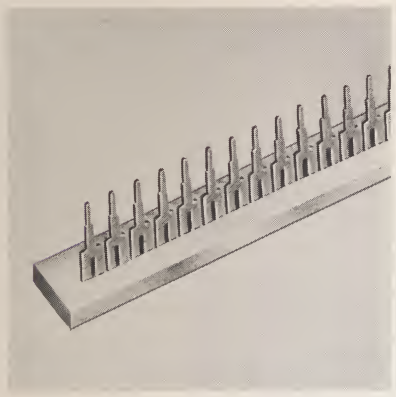

Figure 5

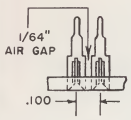

Figure 5a

Figure 6

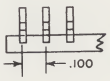

Figure 6a

For certain applications guide-pins and sockets, as illustrated in Figure 7, may be mandatory. Engineering Bulletin 67 describes these in detail. The module card contact has two legs to guarantee its positioning. Only the rear leg can be staked because it is supported by the plastic strip. Staking the front leg would distort the contact nose if staking pressure was applied. Two types of module cards can be used. One type with two holes for two legs at .147″ spacing; the other with one hole for staking of the rear leg, and a slot for the front leg as shown in Figure 8.

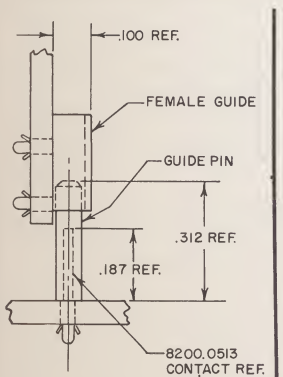

Figure 7

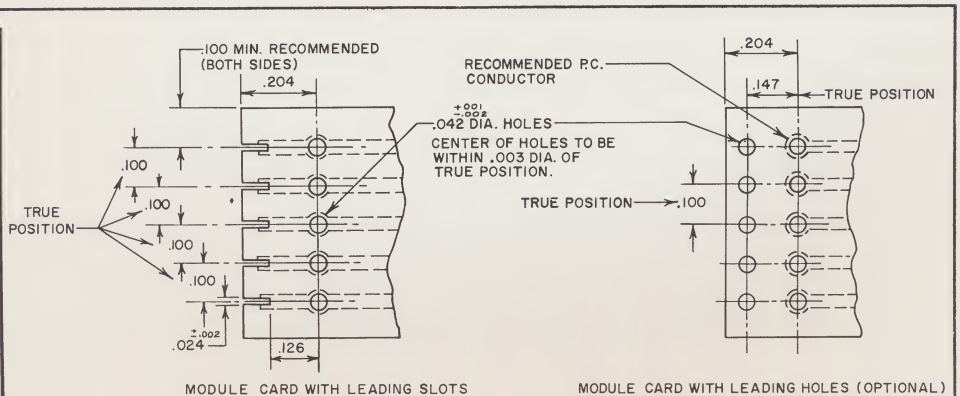

Figure 8

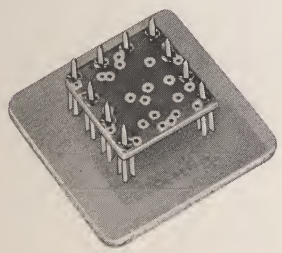

Figure 9a

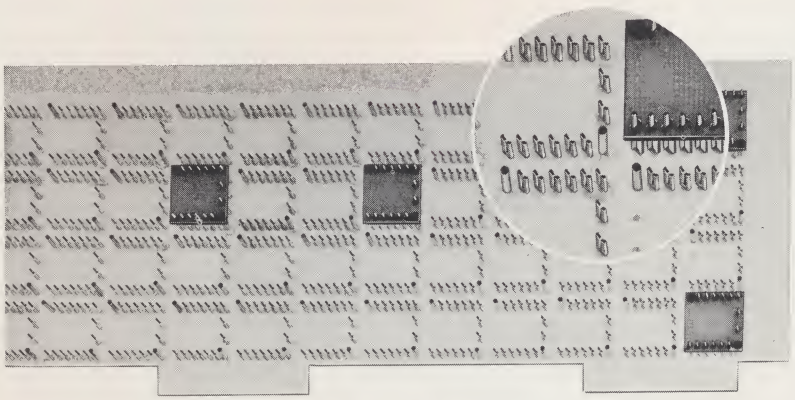

Figure 9b

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b. Card-to-Card Parallel Connectors
Series 5304

A very common application is to build small printed circuit modules with components mounted thereon. These are plugged parallel to a large size mother-card as illustrated in Figures 9a and 9b on Page 6. Any pattern and size can be established, depending on the circuit requirements.

This connector also can be adapted to rack and panel applications. Spacings at .100″ square grid can be used with the individual contacts mounted preferably at 45°. The number of contacts and the pattern can be selected as required. A typical example is shown in Figure 10. Contacts are staked to a laminate molded into a polycarbonate frame. Mounting screws are provided for the purpose of mating, disconnecting, and securing complex units to a common frame.

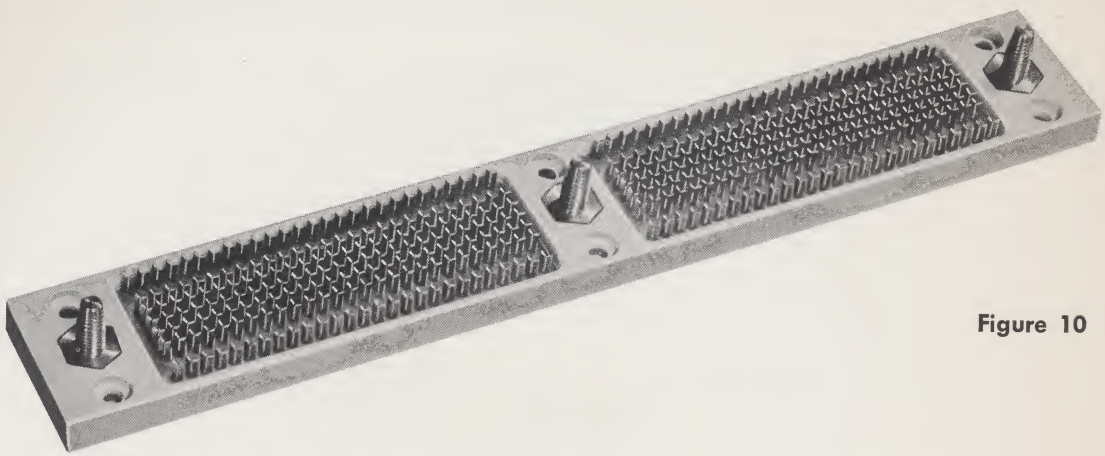

Figure 10

To obtain the mating of two cards, the contact should preferably be fastened to each card at a 45° angle. Stand-off contacts are supplied on plastic strips with any number of contacts up to 120, spaced at .100″ and oriented at 45°. (See Figure 11.) Other spacings can be supplied on request.

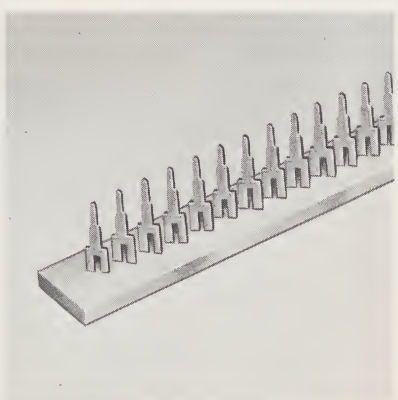

Figure 11

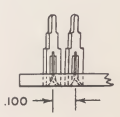

Figure 11a

A feature of Series 5304 connector is that contacts need not be assembled in line at the edge of the module card. They can be located at random at whatever position may be required by the circuit. In such a case, it is recommended that loose contacts be used. These can be assembled by means

of a staking support fixture as described in Engineering Bulletin 51. With a spacing of .100″ between adjacent contacts, and the contacts located at 45°, the air-gap becomes .028″ and the breakdown voltage will far exceed 1,000 volts, RMS.

To obtain spacings of less than .100″, one contact must be mounted at an angle A, the mating one at 90°—A, as shown in Figure 12. The Angle A depends on the spacing. If the air gap a_1 is equal to a_2, its relation is given by:

$$\sin 2A = 1 - \left(\frac{W - d}{2S}\right)^2$$

or for the present ELCO MICROCON* contacts:

$$\sin 2A = 1 - \left(\frac{31}{S}\right)^2$$

if spacing is given in 1/1000 of an inch.

For a spacing of .075″, the angle A is 28° and the air-gap between adjacent contacts becomes .015″, because it is:

$$a_1 = a_2 = S \sin A - d$$

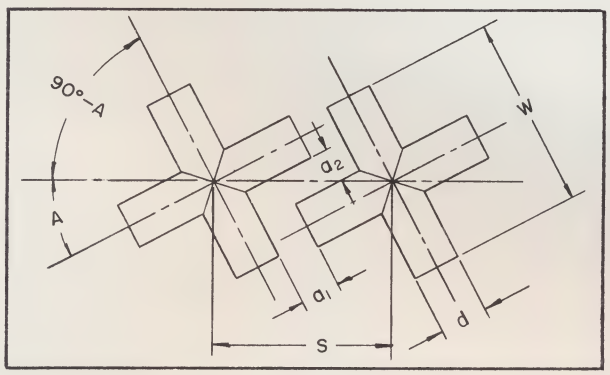

Figure 12

3. CONTACTS MOUNTED TO INSULATORS

a. Series 8203 ELCO MICROCON* Modules

Series 8203 is a one inch square module with 9 x 9 contacts at .100″ square grid. It is available in two types: (1) receptacle type (Figure 13a); and (2) hermaphroditic (Figure 13b). Each type can be supplied in module increments smaller than one inch square. Both can be used as insulators or bases in the construction of circuit modules. Various types of ELCO MICROCON* stand-off contacts can be used. Any number of polarizing guide pins and sockets can be located at any contact position.

1. RECEPTACLE TYPE—The distinguishing characteristics of the receptacle type lie in height of the insulator and its contact cavity construction. The insulator provides a protective casement around each contact. This defines what is essentially the receptacle type, which can be supplied with or without guide pins.

2. HERMAPHRODITIC—The hermaphroditic is produced by reducing the thickness of the receptacle type insulator and exposing the contact noses by 50%. Polarizing guide pins and holes can be provided. Number and location is to be specified by customer. This type permits mating of two such identical modules.

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3. LAMINATES—To mate with the receptacle type, stand-off contacts can be staked and soldered to laminates at .100″ square grid pattern, to provide a base for the construction of circuit modules, or to act as a mother board (Figure 13c).

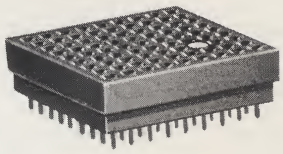

Figure 13a
Receptacle Type

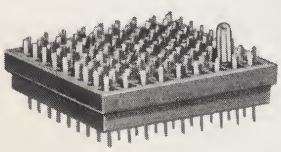

Figure 13b
Hermaphroditic

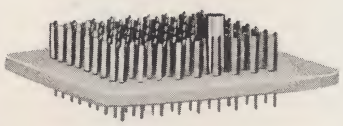

Figure 13c
Laminate

These three basic ELCO MICROCON* module types are illustrated above.

How to Build Circuit Modules

Several types of circuit modules can be constructed by using the module types described in the foregoing paragraphs.

Type 1—Circuit Module

The first step is to build the circuit module between two insulators or wafers. (Figure 14a). These wafers can be laminates or printed circuit cards. The leads of the components penetrate at top and bottom through the wafers. Connections between component leads are established by welding methods if laminates are used. Dip soldering is used for printed circuit cards.

The second step is to weld or solder the wire leads to contact terminations extending through the insulator. A laminate, a receptacle or an hermaphroditic type can be used. (Figure 14b).

The third step is to feed these wires through the holes in the wafers, through the bottom extending through the top, then weld or dip-solder extended wires. Module components must be positioned within the circuitry to allow space for connecting leads. (Figure 14c).

The fourth and last step is to place this fully wired module inside of the cover and pot the entire unit. (Figure 14d). Potting shells for 1″ square made of diallyl phthalate or polycarbonate material in various heights can be supplied.

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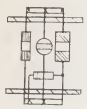

Figure 14a

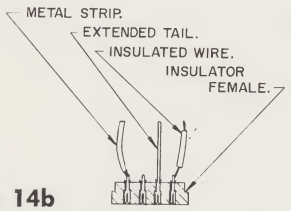

Figure 14b

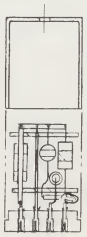

Figure 14d

Figure 14c

Type 2—Circuit Modules

This alternate method for constructing circuit modules is similar to Type I but eliminates the use of the bottom wafer. Component leads are welded or soldered directly to the contact terminations extending thru the insulator base. Any type insulator base can be used. Welding or soldering must begin from the center and work to the outside. Polarizing guide pins can be employed. In this method components are assembled between the insulator base and a top wafer. This alternate construction method is illustrated below in Figures 15a and b.

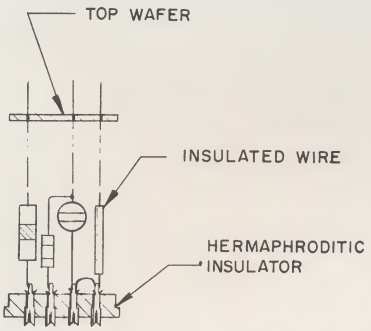

Figure 15a

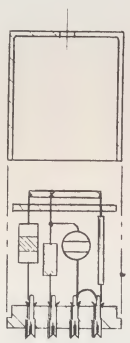

Figure 15b

Other methods of building modules have also been investigated. The technique used depends to a large degree on customer's requirements. The ELCO Engineering Staff will assist in the development of the most suitable technique for the customer.

b. Series 8128 ELCO MICROCON* Rack-and-Panel Connector

A high density Rack-and-Panel Connector using the Series 8200 type contact "nose" is available in three sizes: 25, 37 and 50 contacts, as shown in Figure 16. The exposed male contacts are surrounded by a molded collar for positive protection. Contacts are factory installed. Contact terminations have solder cups made from contact material by rolling. They will accept #22 gage wire.

The details of this connector, its sizes and ordering code are shown in New Product Bulletin 00-8128.

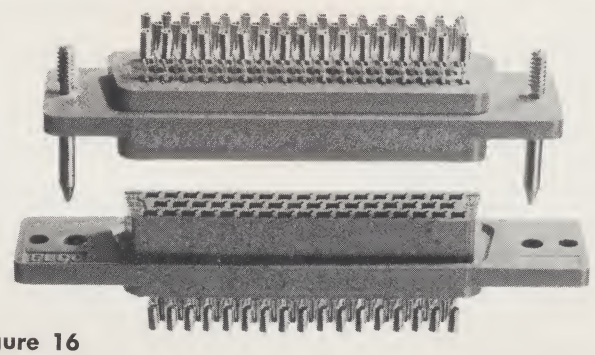

Figure 16

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4. ELCO MODUCON* SERIES 8202

The ELCO MODUCON* is a packaging concept to build pluggable Cordwood Modules. The use of a molded header permits contacts to be fully enclosed within the module, thereby becoming an integral part of it. The header also acts as the framework during assembly of the components and protects the internal contacts during potting. The basic steps to build such pluggable Cordwood Modules with the aid of the ELCO MODUCON* are illustrated in Figure 17a through 17f. No connector is added to the circuit module; the required contacts are treated as components (i.e., resistors, condensors, diodes, transistors, etc.) and they are placed within the module at precise, predetermined locations.

Fig. 17a. Molded header. 18 possible contact locations.

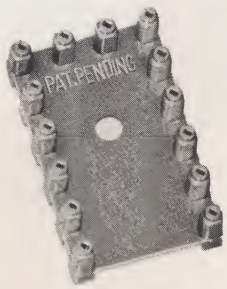

Fig. 17b. Same, similar size, 14 possible contact locations.

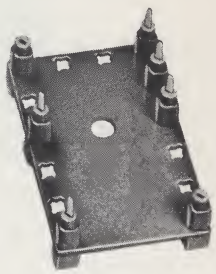

Fig. 17c. Contacts assembled; contact enclosures removed where no contacts are required to gain space for additional components.

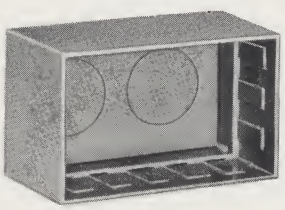

Fig. 17d. Potting Shell.

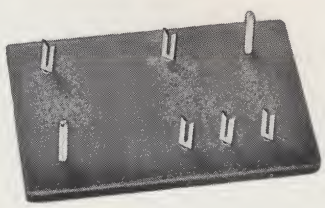

Fig. 17e. Typical mating base with stand-off contacts, guides and polarization pins.

Fig. 17f. Potted Cordwood Module Shell omitted.

The use of pluggable Cordwood Modules is illustrated in Figure 18 on Page 12. A large 1/8" thick, module card with ground plane at one side and circuitry at the other is equipped with stand-off contacts to receive approximately 200 ELCO MODUCON* Cordwood Modules. Stand-off contacts of the module card have wire-wrap terminations to permit interconnections at the rear by programmed wrapping at .200" square grid. Module card with ELCO MODUCON* Modules and 160 contacts in two rows at lower edge, is pluggable to mother card located at bottom of a drawer.

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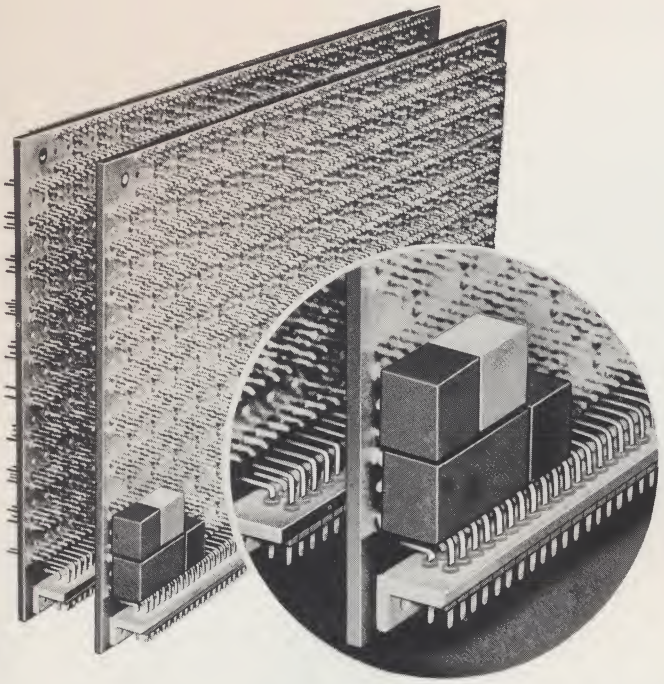

Figure 18

Series 8202 ELCO MODUCON* is now available in three sizes as an "off-the-shelf" item. Other sizes and contact configurations can be tooled on request.

With the superior characteristics of ELCO contacts actually built in, complete flip-flop, logic, counter, pulse, storage, delay, or "custom" circuits can now be provided as readily and reliably as any single component could be heretofore.

- CONNECTOR BODY is a one-piece molded 18 contact-enclosure header to which a potting shell is added following final circuit assembly.
- GUIDES consist of a pin mounted perpendicular to the base card, and a contact-enclosure on the header designated by the customer to serve as a receiving socket.
- MOUNTING is accomplished through final mating of the module with stand-off ELCO MICRO-CON* contacts staked to the base card.
- CONTACT CONFIGURATION is 10, 14, or 18 contacts spaced on .200″ centers in a single row along three edges of the header, in accordance with Signal Corps Cordwood module design specifications.
- CONTACTS are .020″ thick ELCO MICROCON* type, with tails extending into the module for connection to circuit components.
- CONTACT MATERIAL is phosphor bronze, nickel plated and gold flashed.
- STANDARD SIZES are 10 contacts (.740″ x .740″ x .600″), 14 contacts (.740″ x 1.140″ x .600″), and 18 contacts (.740″ x 1.540″ x .600″).
- BASE CARD SIZE is 1/16″ min.
- INSULATOR MATERIAL is polycarbonate in a standard green color. Other colors are available on request.
- POLARIZATION is accomplished by positioning of guide pins and sockets according to the customer's specifications.

New Product Bulletin 00-8202 describes the ELCO MODUCON* Series in detail. Figure 19 gives the dimensions of the header, cover, and accessories as tooled.

Contacts for the ELCO MODUCON* header can be ordered loose or factory installed as described in the Ordering Code in Bulletin 00-8202. Mating stand-off contacts can also be ordered loose; or in plastic strips at desired pattern, outlined in the Ordering Code on Page 14.

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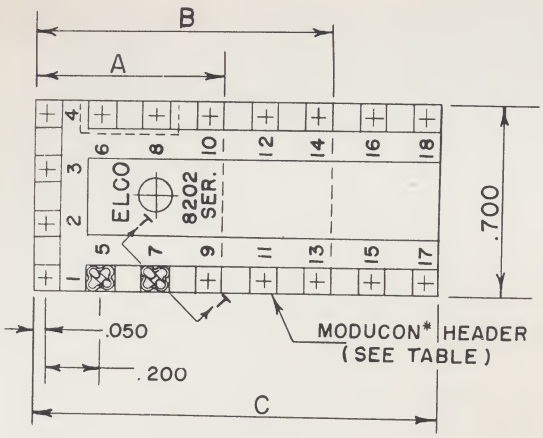
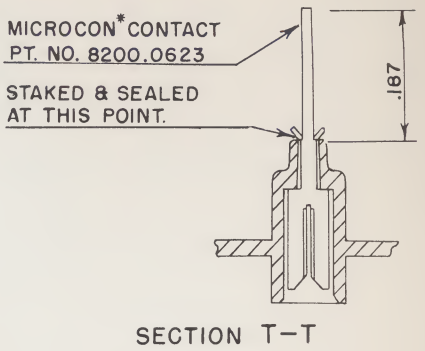
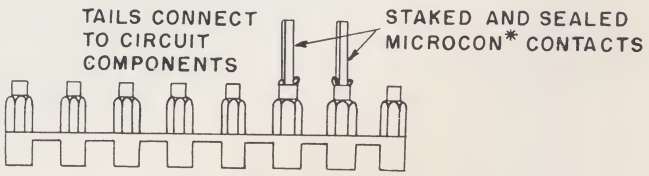
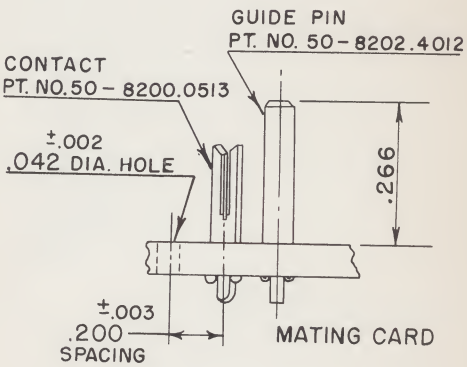




SECTION T–T



HEADER SIDE VIEW — 18 CONTACT SIZE



STAKING TOOL FOR MATING CARD CONTACT AND GUIDES IS ELCO CAT. NO. 56-1280-17

HEADER PT. NO.	DIM. A	DIM. B	DIM. C	SHELL DIM. D
8202.3047	.700			.740
8202.3057		1.100		1.140
8202.3067			1.500	1.540

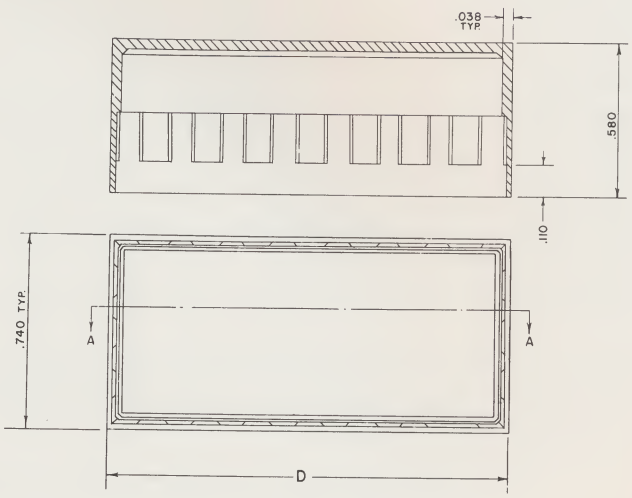


Figure 19

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The following contacts may be used on the mother board to mate with the ELCO MODUCON header:

CODE NO.	CONTACT NO.	CODE NO.	CONTACT NO.
705	8200.0503	701	8200.0213
706	8200.0513	710	8200.0223
708	8200.0523	712	8200.1113
700	8200.0203	707	8200.0623
		710	8200.0233

SPECIFICATIONS

CURRENT RATING: 7 Amperes.

CONTACT RESISTANCE: 0.005 Ohm, Maximum.

CONTACT MATERIAL AND PLATING:
Phosphor Bronze per QQ-B-750, Composition A.
†Nickel plated, 30 to 150 Microinches, followed by gold flash, 10 to 20 Microinches.

INSULATOR MATERIAL:
Polycarbonate-Resin per OS-12531 (Bu. Weps).

INSULATION RESISTANCE: 5,000 Megohms, minimum.

DIELECTRIC WITHSTANDING VOLTAGE (at 52% Relative Humidity):
SEA LEVEL: 1000 Volts RMS.
3.4" Hg: 400 Volts RMS.

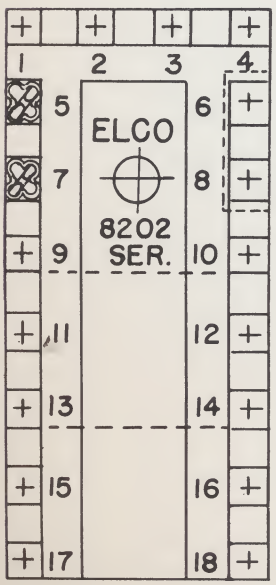
WITHDRAWAL FORCE: 8 Ounces per contact, average.

†ELCO Standard Plating shown. Other plating may be supplied at additional cost.

ORDERING CODE FOR SERIES 8202 MODU-CON*

- **PRODUCT LINE:** 00 (Connectors)
- **SERIES:** 8202
- **NUMBER OF CONTACTS:** 010, 014, or 018
- **CONTACT CODE:** 707 (8200.0623)
- **VARIATIONS:** 016 to 030

00 - 8202 - 018 - 707 - 030



MODULE SHELL PT. NO.	SIZE	GREEN HEADER WITHOUT SHELL	HEADER WITH SHELL			
			GREY	RED	BLUE	GREEN
820231	10 CONTACTS	016	019	022	025	028
820232	14 CONTACTS	017	020	023	026	029
820233	18 CONTACTS	018	021	024	027	030

1—Circle locations where contacts are to be installed. Locations without contacts will be punched out as illustrated in phantom around stations #6 and #8.

2—Place an "X" at contact positions to be utilized as guide pin receptacles.

3—In red, mark and locate any special cut-out or cut-outs desired.

NOTE:
MATING CARD CONTACTS AND GUIDE PINS ARE TO BE ORDERED SEPARATELY.
*USE CATALOG No. 50-8200.0513 FOR CONTACTS. (Or others listed above.)
USE CATALOG No. 50-8200.4012 FOR GUIDE PINS.

*TRADE-MARK

5. CONNECTORS FOR HYBRIDS

Glass or ceramic substrates as used for Hybrids can be made pluggable with the use of 8200 Series edge contacts as shown in Figure 20. These contacts can be mounted at .100″ spacing or .050″ spacing using a contact which has the nose .0375″ offset from its tail center. Single or double sided substrates or two substrates back-to-back can be used at .150″ centers. A detailed description of this application is given in Engineering Bulletin 52C and summarized on the following pages.

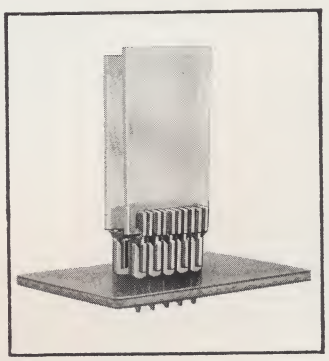


Figure 20

a. 5200 TYPE—ONE ROW
spacing between contacts .100″
spacing between substrates .150″ min.

Here, a new type of ELCO contact with a fork-like termination offers great potential for present and future applications. A typical example, contact 8200.1033, is shown in Figure 21. The dimensions "A" and "B" can be altered to suit substrate thickness. Contacts can be supplied on plastic strips at .100″ center spacing, when sufficient quantities are involved, or shipped loose for mounting to the substrate with the aid of a locating fixture.

The fork-like termination of the contact is sprung open when assembled to the substrate, effecting a high pressure connection between the contact termination and the substrate conductor pad. Soldering the termination to the conductor pad provides an effective means of making the connection mechanically secure. Additionally, each contact is individually secured to the substrate by depositing a globule of epoxy at each solder connection, rigidizing contact alignment, and thereby preventing twisting or movement of contacts during engagement and disengagement. Conductive epoxy instead of soldering can be used to establish the connection.

These contacts with fork-like terminations can be used in a comparatively large number of substrate circuit types. Three are described as follows:

A. A substrate with circuitry on one side only.

B. Substrates having circuitry on both sides, with the contact termination being used to interconnect from front to back, or to connect at the front or only at the back. In each case, a connection is established wherever a conductor pad is located.

C. Two substrates mounted back-to-back, offering the same advantages as "B".

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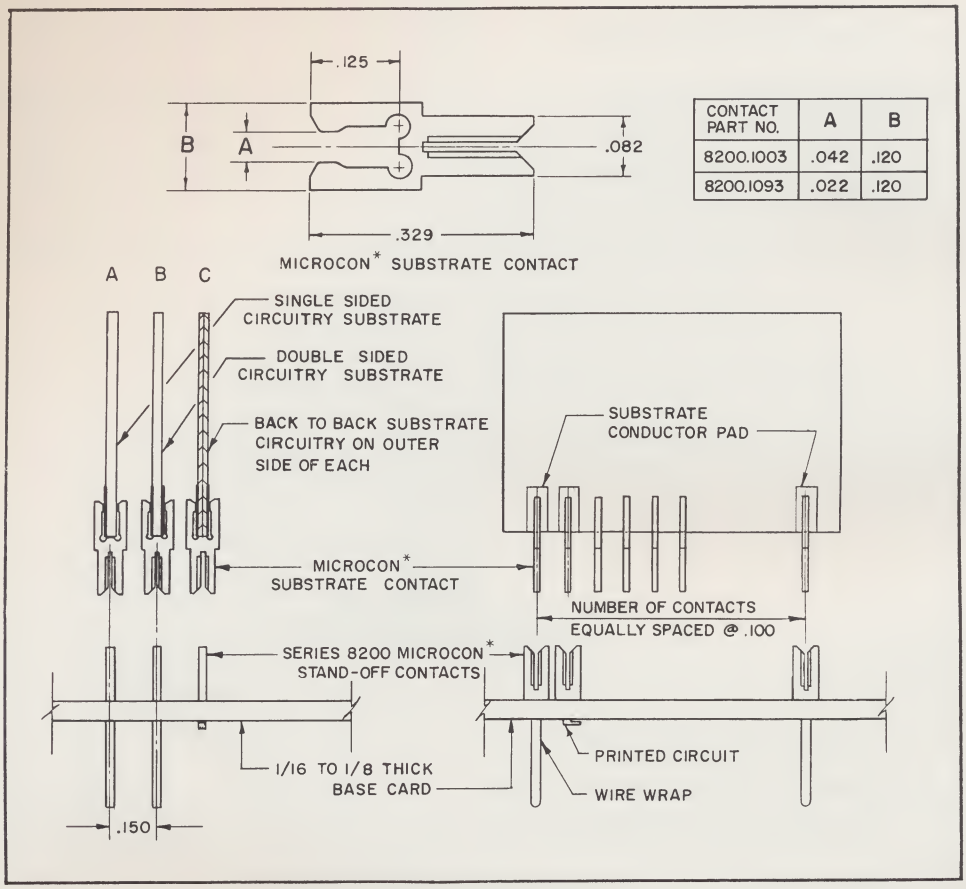


CONTACT PART NO.	A	B
8200.1003	.042	.120
8200.1093	.022	.120

Figure 21

The applications "B" and "C" enable the use of two substrate circuits within the same basic .150" center spacing.

The receptacle contacts on the base card are standard Series 8200 types. They can have terminations for staking and soldering to single sided, double sided, or multi-layer printed circuit cards. Nine contact terminations are available. For wire wrap applications a special contact, 8200.0223 with .020 x .020 x .500" termination, can be employed.

b. 5200 TYPE—OFFSET NOSE CONTACT, TWO ROWS
spacing between contacts .050"
spacing between substrates .150" min.

Contact 8200.1303 shown in Figure 22 is the same as contact 8200.1003 shown in Figure 21, except for its "nose" being offset .0375" from the center of its termination. Its dimensions "A" and "B" can be modified to suit substrate thickness.

This contact is alternately mounted nose right/nose left to the substrate on .050" centers. Consequently, the distance between the nose right and nose left contact centers is .075". Contacts within each row are spaced on .100" centers, the rows offset .050" from each other. This contact pattern also applies to base card mounted stand-off contacts which mate with the substrate. The pattern can be repeated at .150" increments, permitting the same .150" minimum spacing between substrates assembled to the base card.

*TRADE-MARK

Base card mounted stand-off contacts, the same as shown in Figure 21, offer a variety of terminations for staking and soldering to single sided, double sided, or multi-layered printed circuit base cards, and for wire wrapping applications.

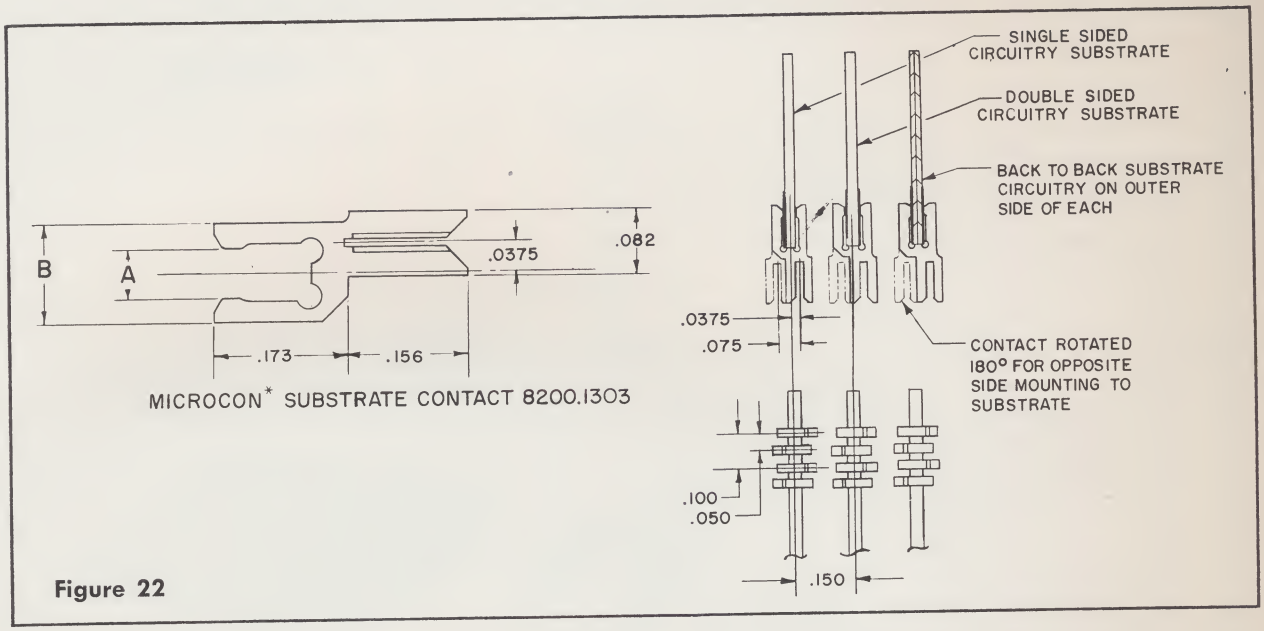


Figure 22

c. 5200 TYPE—SUBSTRATES PLUGGED INTO CONNECTORS
spacing between contacts .050" or .100"
spacing between substrates .150" or .200" min.

As an alternate to employing stand-off contacts mounted directly to a base card in required patterns as described in paragraphs 5a and 5b, molded insulators with contacts retained therein can be utilized.

The molded insulator permits additional flexibility because substrate guides, polarizing pins and holes, and mounting flanges or holes can be integrated into the design of the molded insulator. Any reasonable number of contacts within normal limits is possible with this technique.

Single row contact insulators with contacts "in-line" at .100" spacing, illustrated on the upper part of Figure 23, on Page 18, would be .145" thick to permit mounting of substrates at .150" centers.

Double row contact insulators for substrates with contacts on .050" center spacing, illustrated on the lower part of Figure 23, would be .195" thick to permit mounting of substrates at .200" centers.

d. SUBSTRATE HEADERS

Integrated circuit elements or Hybrids can be made pluggable with the use of a header as shown in Figure 24. Any reasonable number of contacts can be mounted at any pattern to a laminate. The integrated circuit element or Hybrid can be connected to the terminations,

*TRADE-MARK

Base card mounted stand-off contacts, the same as shown in Figure 21, offer a variety of terminations for staking and soldering to single sided, double sided, or multi-layered printed circuit base cards, and for wire wrapping applications.

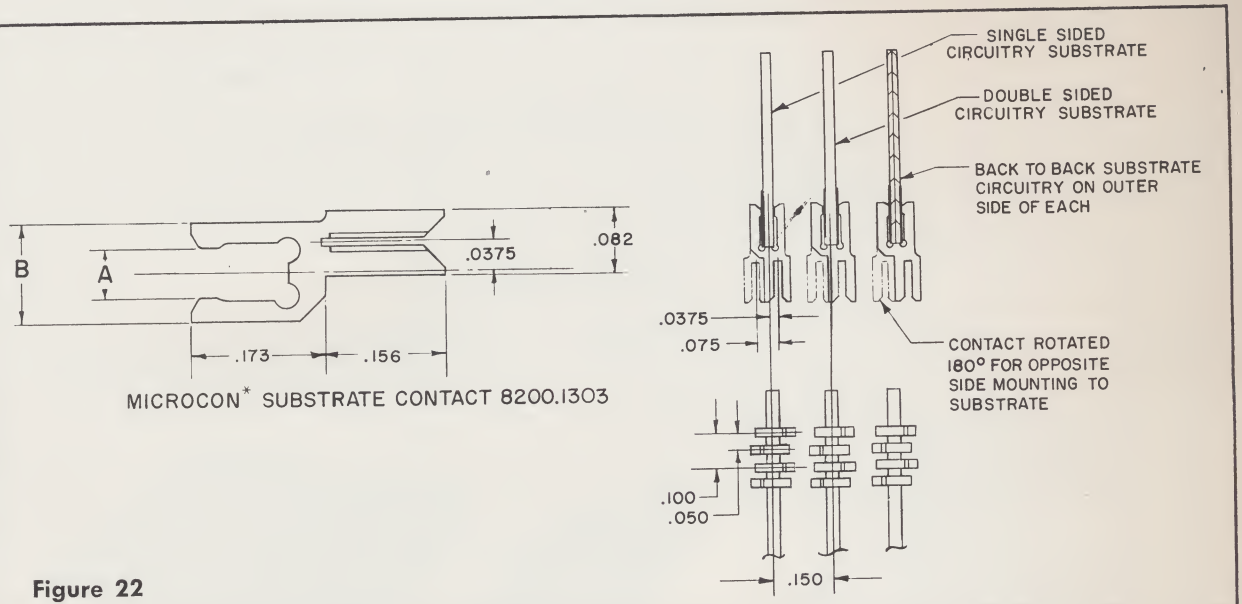


Figure 22

c. 5200 TYPE—SUBSTRATES PLUGGED INTO CONNECTORS
spacing between contacts .050" or .100"
spacing between substrates .150" or .200" min.

As an alternate to employing stand-off contacts mounted directly to a base card in required patterns as described in paragraphs 5a and 5b, molded insulators with contacts retained therein can be utilized.

The molded insulator permits additional flexibility because substrate guides, polarizing pins and holes, and mounting flanges or holes can be integrated into the design of the molded insulator. Any reasonable number of contacts within normal limits is possible with this technique.

Single row contact insulators with contacts "in-line" at .100" spacing, illustrated on the upper part of Figure 23, on Page 18, would be .145" thick to permit mounting of substrates at .150" centers.

Double row contact insulators for substrates with contacts on .050" center spacing, illustrated on the lower part of Figure 23, would be .195" thick to permit mounting of substrates at .200" centers.

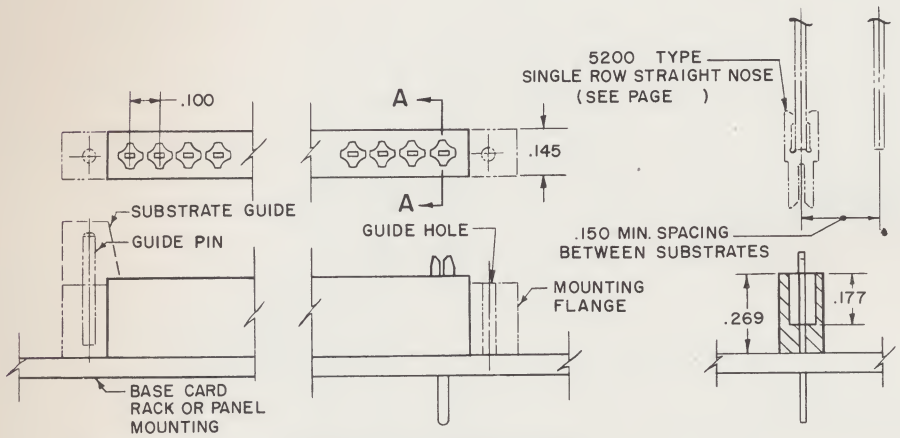
d. SUBSTRATE HEADERS

Integrated circuit elements or Hybrids can be made pluggable with the use of a header as shown in Figure 24. Any reasonable number of contacts can be mounted at any pattern to a laminate. The integrated circuit element or Hybrid can be connected to the terminations,

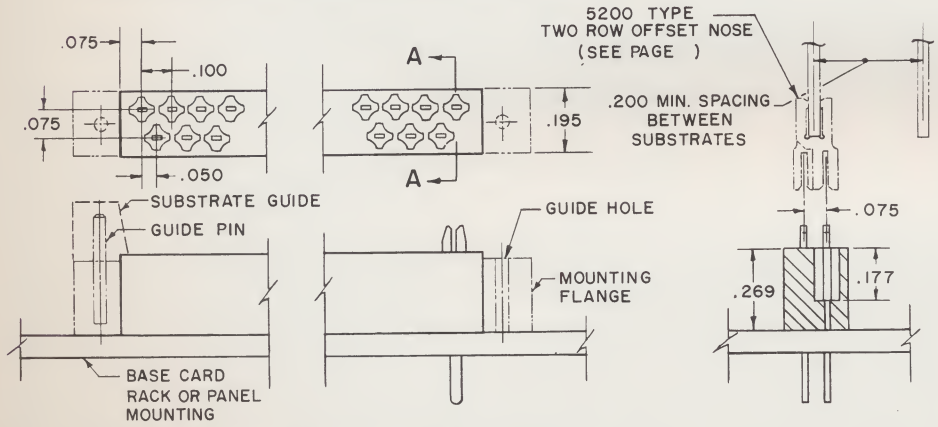
*TRADE-MARK

fitting between two rows of contacts. Thereafter, the entire unit can be potted for protection and handling. The closest contact spacing is on a .100″ square grid.

Figure 24 shows a 10 contact header using the .100″ square grid. One of the 10 contacts is positioned 90° opposite to the others for the purpose of polarization.



SINGLE ROW CONTACT RECEPTACLE INSULATOR



DOUBLE ROW CONTACT RECEPTACLE INSULATOR

Figure 23

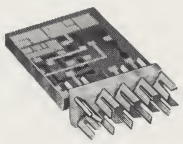


Figure 24

e. MICROMINIATURE SERIES 8208
Printed Circuit Connectors with Intermeshing Insulators for Multiple Stacking

The new ELCO Series 8208 microminiature printed circuit connectors feature insulators molded with corrugated side configurations, allowing multiple stacking without increasing the center distance between rows. They are available in contact sizes from 2 to 96, with self-attaching end blocks with guide pins and sockets, and an arrangement which permits higher density of printed circuit cards.

1. Construction

Insulators, both plug and receptacle, Figure 25a, are molded of diallyl phthalate material. They are produced in lengths for a maximum of 96 contacts, but can be decreased by .100″ increments to any desired length, thereby eliminating additional mold charges.

*TRADE-MARK

Contacts are produced from .020″ thick phosphor bronze material and are identical in the ELCO VARICON* contact mating area with ELCO Series 8200 MICROCON* contacts.

Mounting end blocks, right or left hand, equipped with guide pins or sockets are molded of Zytel 101 material and are provided with a dual dove tail extrusion for attachment purposes.

2. Assembly

The plug insulator is factory assembled with snap lock type upper and lower board contacts which enable the printed circuit card to be inserted between supporting rows of contacts with spring terminations for connection with circuitry on card. After insertion of card, the mounting end blocks are interlocked into the end cavities of the insulator and are secured to the printed circuit card with eyelets. Figure 25b.

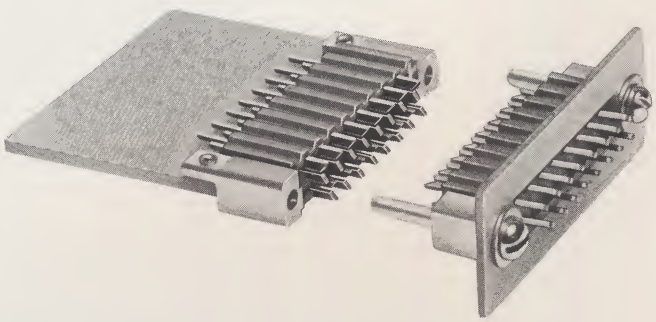


Figure 25a

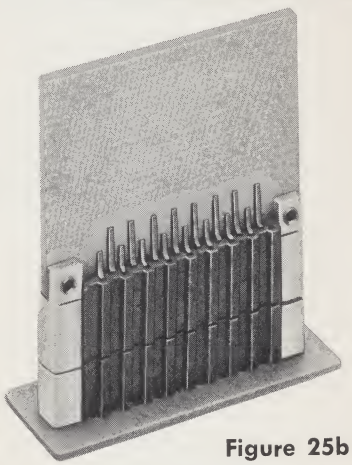


Figure 25b

The receptacle insulator presently utilizes factory inserted contacts with .020″ square printed circuit tail terminations. Panel mounting is achieved by interlocking the end blocks in the end cavities of the insulator and then securing with thread cutting screws.

3. Pattern

The contacts are arranged in a double row offset pattern whereas the center distance between contacts is .100″ and the spacing between rows is .100″. The rows are offset to each other by .050″. Combining this offset pattern with the intermeshing of the corrugated sides enables multiple stacking of connectors on .200″ centers and .100″ between adjacent rows.

The offset pattern arrangements of the plug results with card circuitry terminations being on .050″ centers and the elimination of costly drilling and stacking operations.

f. GENERAL

Paragraphs 5a through 5c describe only the major techniques which are possible for substrate packaging. Other approaches can and have been made. For example: twisting the contact noses at the substrate at a 28° angle as basically described in paragraph 2b will permit mounting of contacts on .075″ centers in one row.

*TRADE-MARK

Outstanding as common to every type of ELCO substrate contact application described herein is the fact that contacts can be supplied on plastic strips or in loose form, and that each contact is available with a fork-like termination to create a pressure connection to the substrate circuitry. Final connection can be established with soldering, reinforced by epoxy or with conductive epoxy around the tail.

Typical for all base-card contacts described here is their adaptability to either printed circuit or wire-wrapping applications.

The ELCO 8200 "family" of substrate connector types is so broad that many variations can be made available to suit any present or future substrate packaging requirement. Request for additional information or consultation on particular needs will receive immediate attention.

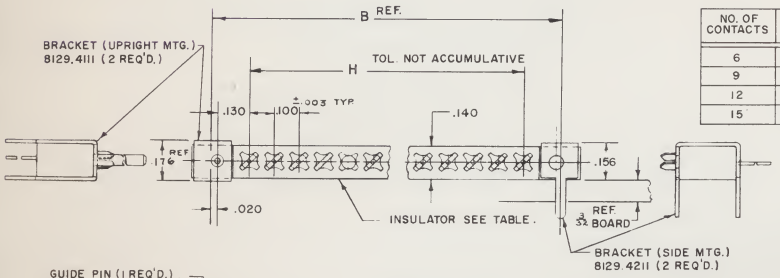
6. SUBMINIATURE SERIES 8129 CONNECTORS
For Pluggable Printed Circuit Boards, Hybrids or Packaging of Integrated Circuits

The 8100 type contacts which are used in this connector series are similar in size to those of the 8200 "family." The material thickness is .017″ against .020″. This 8129 connector is available in the four sizes, 6, 9, 12 and 15 contacts and is a stock item having a wide range of applications.

Contacts in the Series 8129 plug and receptacle are mounted at 45° angles on .100″ center spacing, with 50% of the contact mating area extending beyond the insulator front.

a. Printed Circuit Application

Figure 26 shows the dimensions of this connector and its accessories. Brackets for side or upright mounting can be supplied. Each insulator made of diallyl phthalate is supplied with one guide pin and one guide hole molded into the insulator. This results in a complete hermaphroditic design. Polarization pins can be employed at any contact position, replacing a contact pair.



NO. OF CONTACTS	PART NO.	B	C	H ±.003
6	8129.3015	.800	.960	.500
9	8129.3025	1.100	1.260	.800
12	8129.3035	1.400	1.560	1.100
15	8129.3045	1.700	1.860	1.400

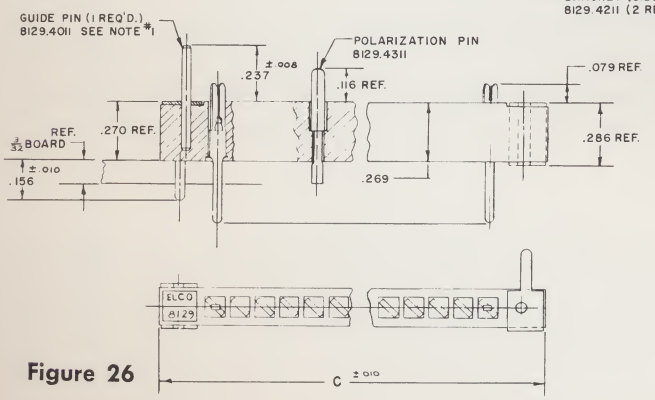


Figure 26

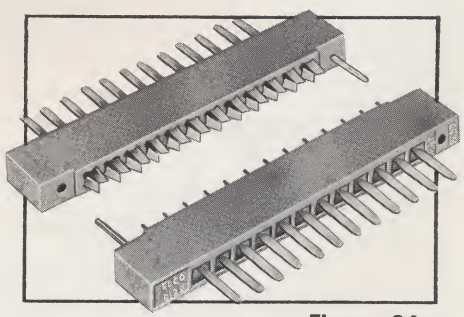


Figure 26a

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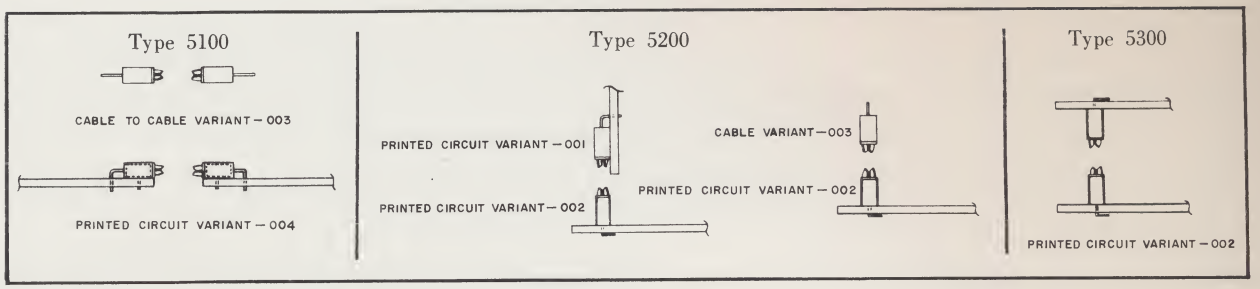


Figure 27

The three basic connections can be established as shown in Figure 27. Cards or cables can be connected within the same plane (5100 type), or at 90° to each other (5200 type) or parallel to each other (5300 type). Unlimited variations of applications are possible. The ordering code of this connector and the recommended hole layout for the printed circuit cards are shown in Figure 28.

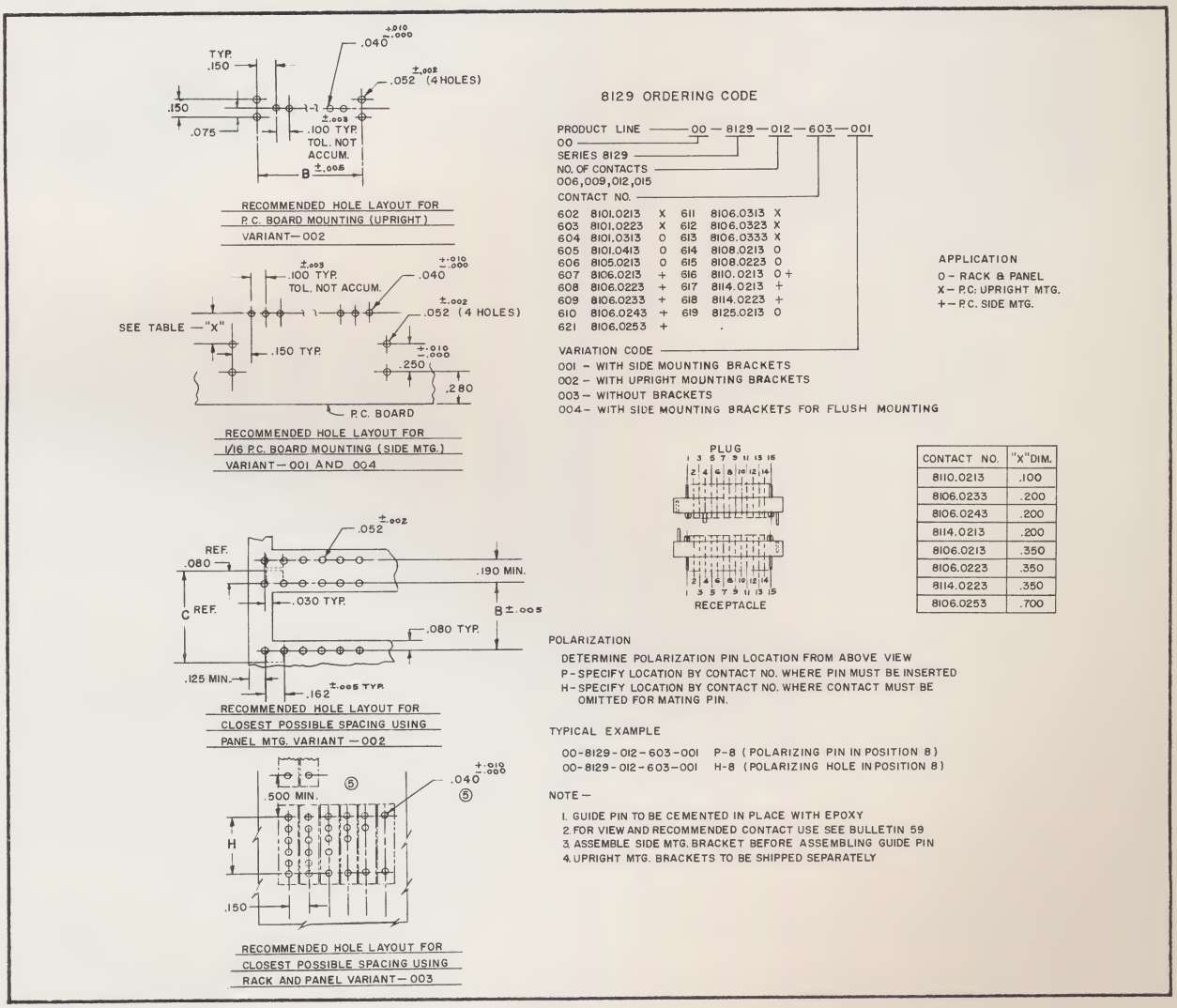


Figure 28

The receptacle can also be supplied with a variety of contacts, including termination types for: (1) soldering to wires, (2) taper tab use, (3) soldering to single or multi-layer printed circuit cards, (4) wire wrapping applications.

b. Application for Hybrids or Integrated Circuit Elements

The Series 8129 connector plug can be cemented to the circuitry side of the Hybrid along the edge as shown in Figure 29. Contact noses are on .100″ spacing at 45°. Tails are twisted and factory bent to lie flat against the substrate conductor pads. Contact terminations of various lengths are available. Also available are short terminations which connect to conductor pads,

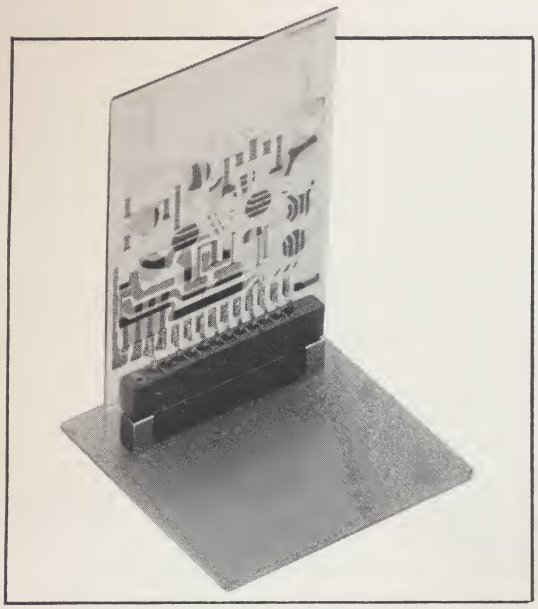


Figure 29

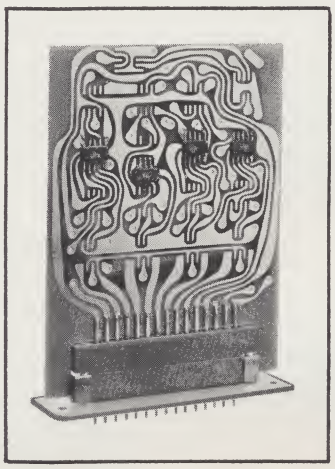
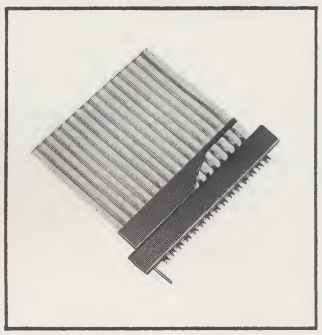


Figure 30

Figure 31



close to the front edge of the substrate. Long terminations connected to conductor pads, substantially away from the edge of the substrate, are also available. Soldering to the conductor or conductive epoxy can be employed to establish reliable connections to the circuitry. With an average .040″ substrate thickness, connectors can be mounted on .200″ centers.

The mating Series 8129 receptacles can be mounted to a chassis or mother card as outlined in paragraph 6a. As listed therein, a variety of contacts are available for solder connections to wires, for printed circuit applications, or for wire wrapping.

Frequently, printed circuit module cards are used to mount and inter-connect a group of integrated circuit elements. Each module card can easily be made pluggable with the Series 8129 connector mounted to its edge as shown in Figure 30. Note, the connector is not cemented on top of the edge of the printed circuit board as is commonly done. A cut-out is provided at this edge and the connector is recessed within the board. The total thickness of the module is .140″ (equal to the connector thickness) and permits mounting of these integrated circuit element module cards at .150″ spacing.

c. Application for Flexible Cables

The new ELCO method of welding Flexible Cables directly to the tails of the connector without removing the insulation is very suitable for Series 8129 as shown in Figure 31. For the purpose of protection and strain-relief the welded joints are covered by various methods, depending on the application.

A connector plug of this type with Flexible Cable attached as shown in Figure 31, can mate with its receptacle in the various ways previously described in Figure 27.

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7. CONNECTION METHODS

Most of the common interconnection methods can be used in this sub-miniature ELCO VARICON* connector series as briefly outlined below and illustrated in Figures 32a thru 32i.

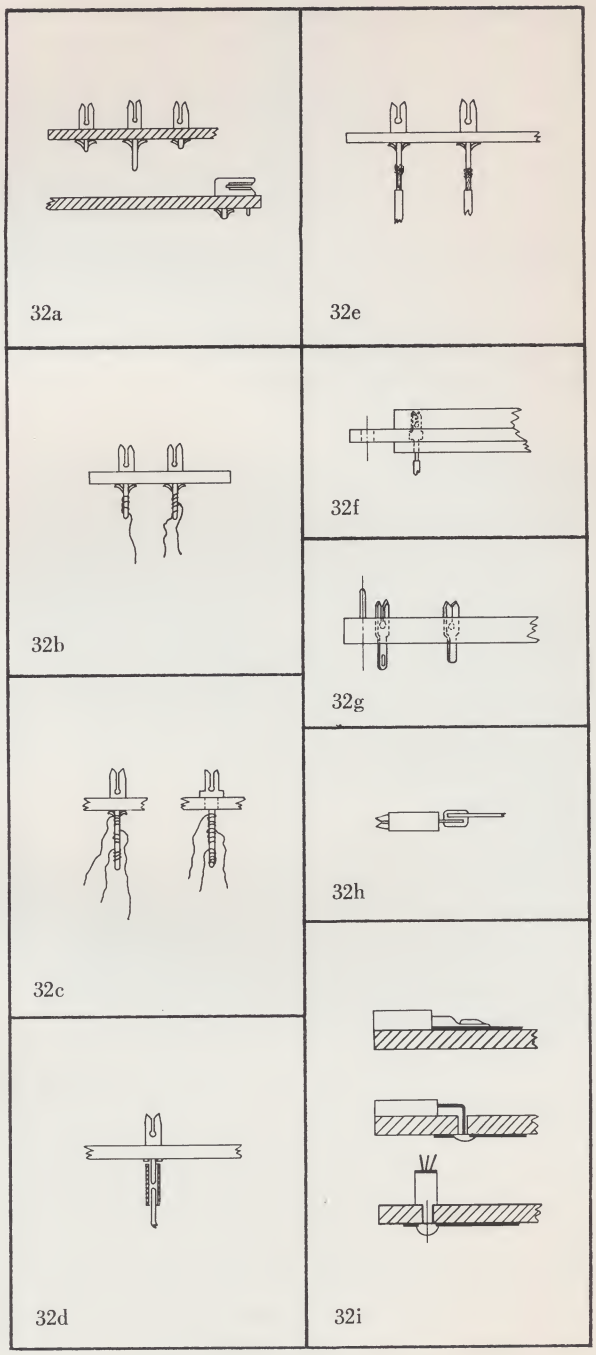
32a. Staking and soldering to printed circuit cards. Applicable for single sided, double sided, and multi-layer printed circuit boards.

32b. Soldering of wire interconnections to extended contact tails. Root of contact tail may be staked and soldered to printed circuit lines.

32c. Wire-wrapping to contact tails. Various tail configurations of tail area and tail length can be supplied.

Depending on card size and type, contacts can be staked to laminates or staked and soldered to printed circuit type laminates or secured by interference fit if the card is of sufficient thickness.

32d. Solder sleeve for connecting wires. A thin brass sleeve can be fitted over the extended tail of the contact after it is secured to the base by staking or press fit. A wire can then be soldered to the other end of the sleeve, the solder thereby connecting the sleeve to tail and wire conductor.



32e*. PERCUSSIVE WELDING of solid or stranded wires to the extended tails of the contacts results in a neat connection for close contact spacing.

32f. SOLDER CUP. A special contact is used in the rack-and-panel connectors, Series 8128. The contact is made of a two-stage material with a typical 8200 type nose being .020″ thick and a rolled solder-cup tail, made of .012″ material. The contact is factory installed, secured to the insulator by twisting.

32g. TAPER TAB and WIRE HOLE tails can be supplied in the Series 8129 for conventional methods of securing wires to the tails in rack-and-panel applications.

32h. WELDED RIBBON CABLE connections can be established as described in Paragraph 6c.

32i. SOLDERING TO PRINTED CIRCUIT LINES. Contact tails can lay flat on top of printed circuit or substrate conductors to which they are soldered or secured by conductive epoxy in the case of substrates.

Tails can go thru holes of printed circuit boards, soldered to conductor pads underneath the board extending straight or being bent flat against the pad.

* The connection methods above are all established and well known throughout the industry with the exception of 32e, Percussive Welding, which is new and described in length as follows:

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Percussive Welding

Percussive welding, Figure 33, involves the bringing together of 2 metal workpieces, fairly rapidly. Just before they meet, a flash of electric arc melts both colliding surfaces. The molten surfaces are then squeezed together by the collision and some of the metal is forced out of the sides of the joint. Actually, the process works in this manner: capacitor bank is charged first and then one workpiece is advanced toward the other. When the parts are close enough the capacitor bank discharges between them. The intense arc that is generated, for a fraction of a millisecond duration, melts the localized areas to be joined; these areas are then forged together as one of the workpieces is impinged upon the other. Resolidification is also extremely quick. The various action units outlined occur rapidly, one after the other, as the hand welding gun is used.

All these steps are closely controlled. The charging voltage, the total capacitance, the forging force and speed of the approaching parts, and the value of the series resistance are all important in making a good weld. The voltage and capacity determine the energy stored in the system and consequently, the heating effect of the arc.

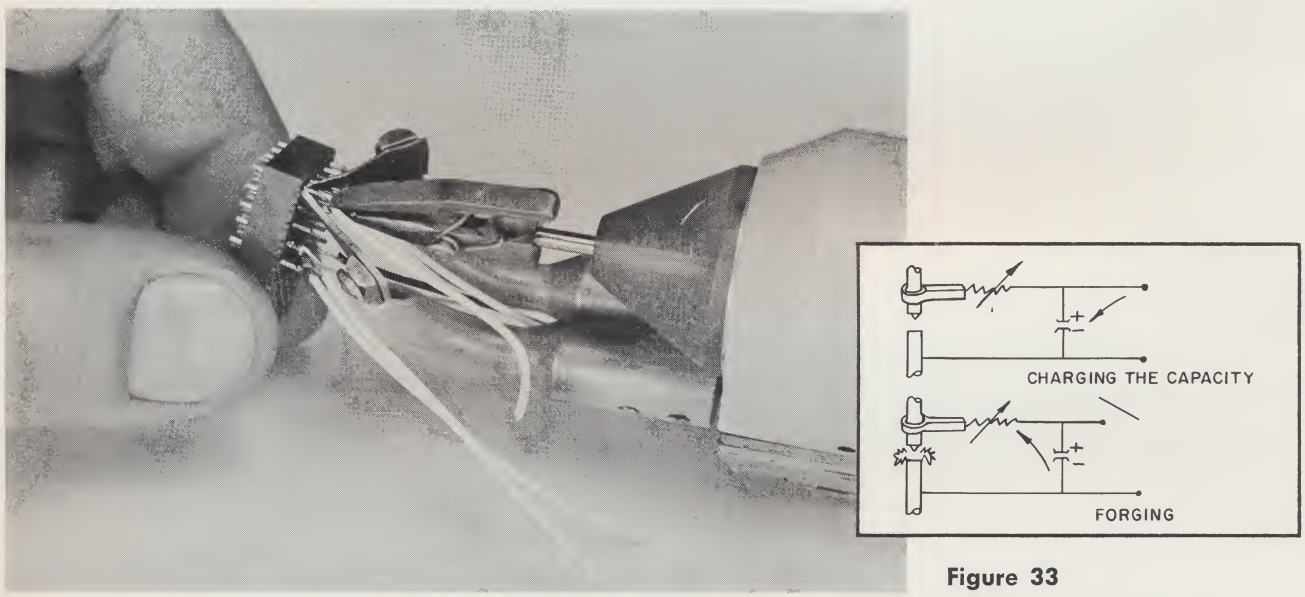

Figure 33

Advantages of Percussive Welding

(1) Low sensitivity to conductivity and melt points of workpieces so dissimilar metals can be welded as well as workpieces of entirely different sizes and masses—including wires of .002 inch diameter.
(2) True fused welds are obtained instead of cold or porous welds.
(3) Stranded or solid wires may be welded (wire is stripped back about ⅛ inch).
(4) Wide tolerance of voltage and capacitance permits much variations in workpieces at one setting.
(5) Heat is generated only at weld areas—offsetting possibilities of heat damage.
(6) Weld can be visually inspected—but tensile tests must be made for assurance of good welds.
(7) Weld strength equals or exceeds tensile strength of welded wire.
(8) Standard 120 volts and 60 cycle current is used to drive power pack.

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(9) Portable welder and power pack is brought *to* the work.

(10) Percussive Welding is rapid.

(11) It permits close welding—great space saving.

ELCO uses and is further developing the Percussive welding technique. Our company uses a hand gun welder which is a basis for its development. It is also designing and modifying contacts and connectors for this advanced method.

8. SUBMINIATURE AND MICROCON* CONTACT SURVEY

A large variety of contacts have already been developed and are available from hard tooling as stock items. New variations are continuously added. MICROCON* contacts can be supplied on plastic strips, if the quantity warrants. Contact strip fixtures are tooled for the most common spacing of .100″.

A survey of the most common Series 8100 contacts and Series 8200 contacts is given in the tables which follow.

a. Series 8100 Subminiature Contacts

8101.0213	Printed circuit contact for 1/16″ thick card with 3/16″ tail.	8106.0313	Printed circuit contact with 41/46″ tail.
8101.0223	Printed circuit contact for 3/32″ thick card with 1/4″ tail.	8106.0323	Printed circuit contact with 3/8″ tail.
8101.0313	.078″ taper tab tail contact.	8106.0333	Printed circuit contact with 33/64″ tail.
8101.0413	Wire hole contact with .078″ taper tab tail.	8108.0213	Printed circuit contact with "V" formed 3/16″ tail.
8105.0213	Conventional "T" shaped solder termination contact with 3/16″ tail.	8108.0223	Printed circuit contact with "V" formed 17/64″ tail.
8106.0213	Printed circuit contact for 1/16″ thick card with tab stop, 41/64″ tail.	8110.0213	Printed circuit contact with 1/4″ tail.
8106.0223	Printed circuit contact for 1/16″ thick card with tab stop, 43/64″ tail.	8114.0213	Printed circuit contact with 33/64″ tail.
8106.0233	Printed circuit contact for 1/16″ thick card with tab stop, 3/8″ tail.	8114.0223	Printed circuit contact with 43/64″ tail.
8106.0243	Printed circuit contact for 1/16″ thick card with 3/8″ tail.	8125.0213	Printed circuit contact with 3/16″ tail.
8106.0253	Printed circuit connector for 1/16″ thick card with tab stop, 57/64″ tail.		

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b. Series 8200 MICROCON* Type Contacts			
8200.0203	Stand-off contact for 1/32″ thick card with short extended tail.	8200.0623	Stand-off contact for 1/16″ thick board with short wire-wrap tail, .020 x .020 x .250.
8200.0213	Stand-off contact for 1/16″ thick card with short extended tail.	8200.1003	Substrate contact for .048″ thick substrates.
8200.0223	Stand-off contact for 1/16″ thick card with wire-wrap tail, .020 x .020 x .400.	8200.1093	Substrate contact for .030″ thick substrates.
8200.0303	Module board contact for 1/32″ thick card.	8200.1113	Stand-off contact for press-fit to 1/8″ thick card with wire-wrap tail, .020 x .024 x .500.
8200.0313	Module board contact for 1/16″ thick card.	8200.1213	Contact for MODUCON.*
8200.0503	Stand-off contact for 1/32″ thick card.	8200.1303	Substrate contact for .050″ spacing and .040″ thick substrates.
8200.0513	Stand-off contact for 1/16″ thick card.	8128.0213	Solder cup tail contact used in Rack and-Panel Connector 8128 Series.
8200.0523	Stand-off contact for 3/32″ thick card.		

9. TOOLING

The 8100 type contacts are made from .017″ thick material. They are not used for staking to printed circuit cards. They are factory installed to various types of connector insulators, especially in the 8129 Series. If these connectors are used in connection with printed circuit cards, the contact tails can lay flat on top of the printed circuit tabs to which they are soldered, or their tails can go through holes of the printed circuit card and can be bent flat against the printed circuit pads (underneath) to which they are soldered.

The 8200 type contacts are made of .020″ thick material. They are additionally usable for staking to printed circuit cards or for securing to laminates by press-fit with or without additional soldering.

The various possible connection methods are described in detail in Section 7.

Figure 34—Staking Punch: knife like staking tool which shaves material at one or both sides of the leg and bends this material tightly against the copper lines of printed circuit card.

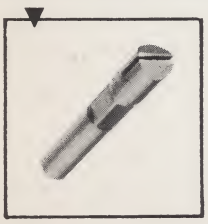
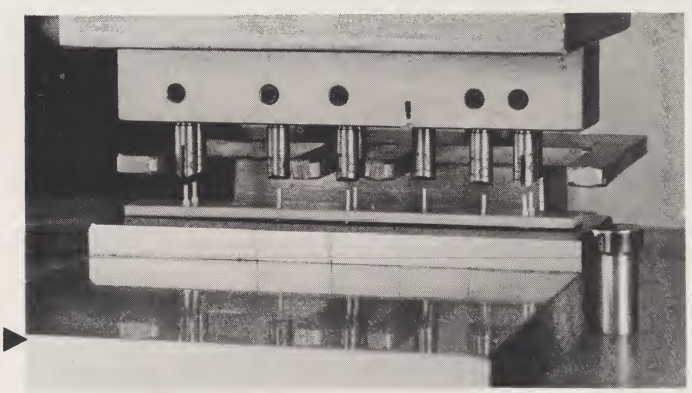


Figure 35—Staking Punch Holder: one of many typical custom-built staking heads used in staking Series 8200 contacts to module cards.



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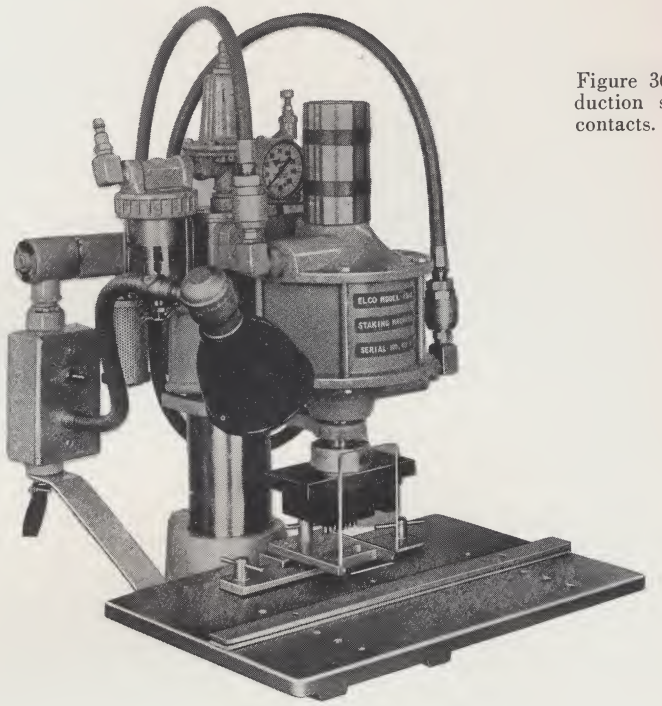

Figure 36—AS-2 Air Staker: facilitates the production staking of most ELCO printed circuit contacts.

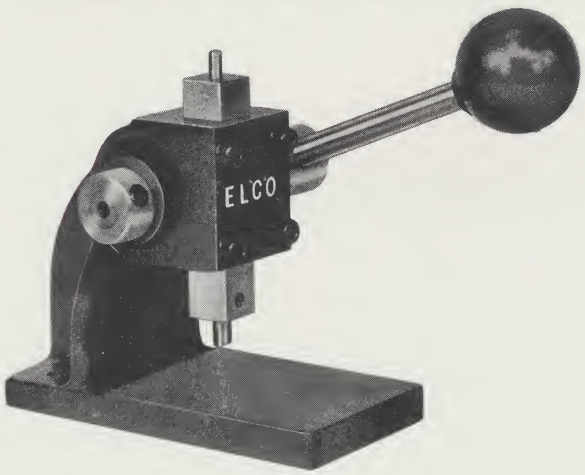

Figure 37—Hand Staker: to accommodate the staking of most types of ELCO contacts on a model shop or laboratory basis.

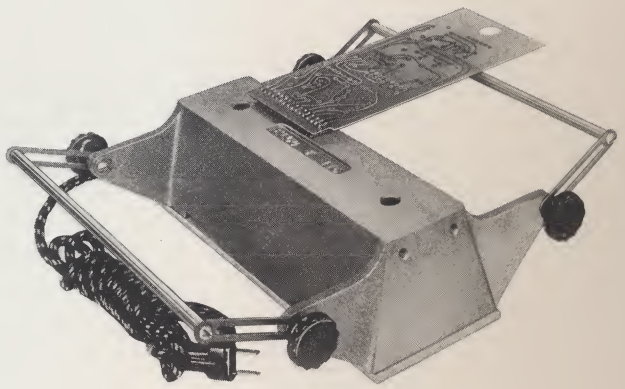

Figure 38—Heating Platen: designed to easily remove plastic strips—when contacts are supplied thereon—after staking and soldering operations are completed.

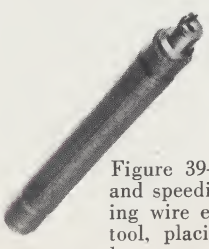

Figure 39—Hand Wrapper for Soldering: easily and speedily accomplishes wire-wrapping by placing wire end to be wrapped in off-center hole of tool, placing center hole against termination to be wrapped, then spinning tool with fingers.

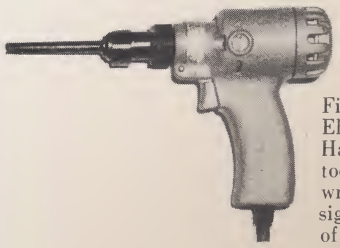

Figure 40 — Gardner-Denver Electric Wire Wrap Tool. Hand-, air-, or battery-operated tools are also available. Our wrapping specifications are designed in accordance with those of Gardner-Denver Co., and completely covered in ELCO Engineering Bulletin 55.

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10. SUMMARY

This Bulletin has described some of the many design approaches to miniature interconnection problems—both those accomplished and those proposed. The basic principles are the same as, and adapted from the successful applications of the standard ELCO VARICON* contact "family."

Contacts can be applied in three manners: (1) loose; (2) on plastic strips; and (3) in insulators. They can be staked, twisted or cemented into position; grouped at definite spacings or located at any desired random pattern.

It is true that the ELCO miniature connector "family" solution possibilities are limited only by the ingenuity of the equipment designer; yet our own experience in this newest state of the interconnection art may be of great assistance in suggesting specific solutions to you. We would be most happy to investigate such solutions with you upon the receipt of your inquiry.

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